Special Radio Course in Three Months

In response to the many requests received by the School of Engineering of Milwaukee for competent men who can design, merchandise, install and service radio equipment, the School of Engineering of Milwaukee, owner and operator of Radiocast Station WSOE, is pleased to announce the opening of a three months course in Radio, covering all its branches in a very practical way.

The course is arranged in such a way that, if the student already has some knowledge of radio, he will not find the subjects monotonous or tiresome. A review of the fundamental principles will, perhaps, be easier for such a student. The course does not require a technically educated man, nor one who is possessed with a good training in mathematics.

The course of instruction covers:

Radio Broadcasting Stations

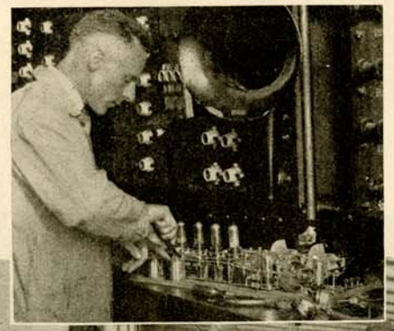
Designs of transmitting antennas. Theory and operation and radio transmitting tubes. Capacity and inductance methods of tuning in radio transmitter. Methods of modulation used in radiocast stations. Local and remote control speech amplifiers. The advantages of the impedance coupled amplifier. Water cooled tubes and their use in super-power stations. Design of remote control amplifiers. Power supply for the radio broadcasting stations. Storage battery and motor generator equipment. Design of radio broadcasting studios. Study of acoustics.

Commercial Code Stations

Brief study of spark apparatus. Design of code transmitters, arc transmitters, theory and operation of each type. The high frequency alternator as a means of producing radio frequency energy. Exhaustive treatment of the vacuum tube transmitter, using different types of vacuum tubes. The converted spark transmitter. The use of water cooled tubes in super-power commercial stations. Methods of keying the transmitter. Grid bias battery and grid leak method of keying. The instruction, operation and maintenance of radio code transmitters, traffic management and management of personnel of the station. High speed automatic transmitters and receivers used in large commercial stations. The Creed recorder and automatic transmitter in use by stations owned by the United States Government.

Radio Receivers

Early types of radio receiving equipment. Capacity and inductance and their relation to the frequency of the radio receiver. Relation between capacity and inductance, and voltage, and current relation. The regenerative principle. The super-regenerative receiving set. Development of the super-hetrodyne as a modulation, of the super-regenerative principle. Characteristic curves of the vacuum tubes. Oscillation in radio frequency amplifiers. The Hazeltine capacity method of neutralization. Radio and audio frequency amplifiers. Vacuum tube as a detector of radio waves. Design of audio frequency amplifiers. The impedance coupled amplifier. Transformer coupled. Resistance coupled amplifiers. Distortion in audio frequency amplifiers. Usual sources of trouble and suggested remedies. Radio service of the broadcast receiver.



A SECTION OF THE RADIO LABORATORIES.
In Foreground—Students engaged in testing and adjusting radio receiving sets. Here the students have the opportunity to apply the principles they learn at radio lectures.

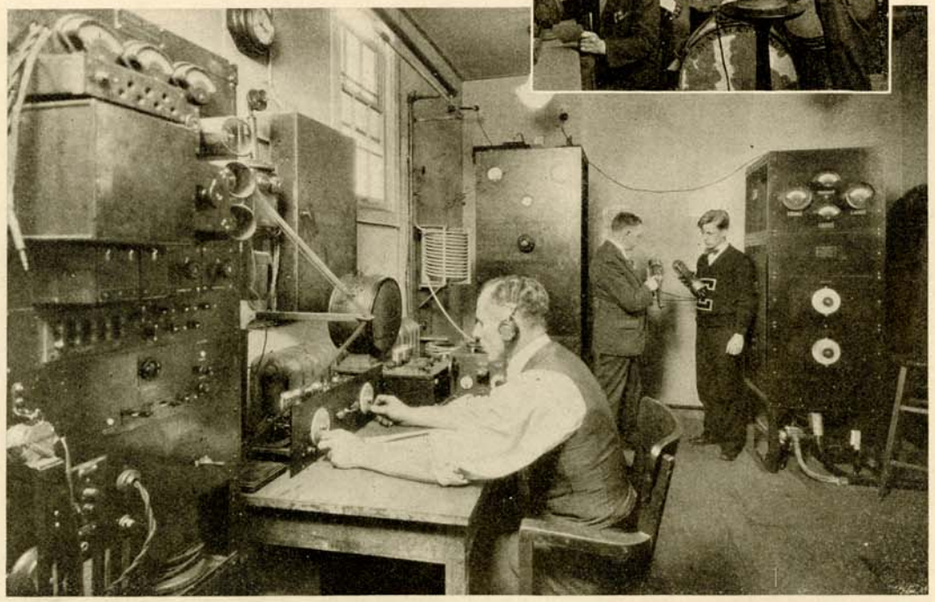
Broadcasting Part of Your Training

Radio Theory and Operating

The design and function of the antenna. Different types of antennas. Antennas for transmitting, antennas for receiving. General principle of transmitting and receiving. Magnetism and its application to radio. Static and dynamic electricity. Chemical cells covering electric circuits. Study of the storage battery. Units of electrical measurement. Electro-magnetic induction and its application to radio principles. Theory and operation of the induction coils. Principles of the alternator and the high frequency alternator, used as radio frequency transmitters. Induction, methods of calculation and its application to radio circuits. Generators and power supplies for radio transmitters. A brief study of electrical motors, motor starters and motor generators. Power transformers. Principles of induction, as applied to radio circuits. Condensers and methods of measurement, their use in various parts of the radio circuits. Methods of calibrating and testing condensers used in radio circuits. Oscillating current and a study of the various methods of generating oscillations. Resonance and coupling, and transmitting and receiving circuits. Wave lengths and tuning by variable inductance, and by variable capacity, and the combination of the two methods. A damping of radio waves, and reduction of decrement. Study of spark gaps, rotary spark, rotary quenched, and stationary quenched gap. Auxiliary storage batteries as used aboard ship installations. Sound waves and a study of various audio frequencies. The telephone receiver and a study of the different types of loud speakers. Early types of detectors. The receiving antenna. The arc as a generator of high frequency waves. Principles of the vacuum tube. The vacuum tube as a detector of radio waves, vacuum tube as an amplifier, audio and radio frequency. The principle of regeneration and its application to vacuum tube transmitters. Radio telephone, methods of modulation. Modern design vacuum tube receivers, amplifiers. Motors. Measurements on standard commercial equipment. The installation and care of radio apparatus used in commercial radio stations. Troubles in repair work. Study of the radio compass and its application to navigation.

Commercial Operating

Code instruction. Advanced code. Types of equipment used on board ship. The equipment used by the United States Army. Arc, spark and alternator transmitters. Vacuum tube transmitters. The converted R. C. A. spark transmitter. Water cooled vacuum tubes. Types and design of super-power transmitters. High voltage supply for power tubes. Water circulation and safety devices used. Western Electric equipment. General Electric equipment. Traffic management.



Some of the electrical apparatus in the Transmission Room, including amplifier and control-panel on the left; broadcast transmitter panel on the right; the power amplifier panel with its water-cooling coils in the central background. One of the four 250-watt tubes used for oscillators and modulators are held by the operator on the right for comparison with the 5,000-watt water-cooled tube used in the radio-frequency amplifier, and seen at the left.

Standard Equipment, Modern Studios

RADIO SALES AND SERVICE

Management of radio factory, personnel of factory, executive department, distributors and jobbers, field representatives. Methods of production in radio factory, radio advertising for radio trade journals, daily newspapers. Radio broadcasting as an advertisement. Retail salesmanship. The installation and servicing of the radio receiving set. Plans of payment, cash and deferred payment plan. Collection. Judging the value of radio equipment. The fundamentals of public speaking necessary for successfully managing a radio business. Student reports from radio periodicals on subjects of interest and debate. Servicing of radio broadcast receivers. Trouble shooting and methods of locating cause of in-operation in a radio receiver. Temporary antenna installation for demonstration of radio receiving set.

Technical Description of Radio Equipment of Radiocast Station WSOE

The SCHOOL OF ENGINEERING OF MILWAUKEE was one of the first of Wisconsin's educational institutions to realize the tremendous importance of radio, and to visualize its great possibilities as a disseminator of information.

Starting with a one-kilowatt spark transmitter, back in 1914, and operating under the amateur call of 9YAD, the school has progressed through the amateur stage of radio to a position with the leaders in the broadcast field.

In 1922, the spark transmitter was abandoned and a 100-watt broadcast transmitter designed and built by students of the school. It went on the air, first, under the call of WIAO.

This 100-watt equipment was operated daily until the more powerful 500-watt transmitter was installed July 7, 1925; and, in the fall of 1926, the power of the station was raised to 1,000 watts.

The equipment is Western Electric apparatus, and consists of five panels, including the power-amplifier.

The power equipment to operate this transmitter system consists of Willard "A" and "B" storage-battery installations. The "A" battery includes 15 cells of the C B R, 540-ampere-hour type, charging normally at 50 amperes, together with its charging and switching apparatus. The "B" battery consists of 1,600 cells, (3200 volts) of T B R 15 ampere-hour special broadcasting type.

The towers, supporting the antenna and counterpoise on the roof of the School of Engineering Building, are constructed of steel, designed similarly to the regular high-power transmission-line towers, and reach to a height of 175 feet above the ground, or 227 feet above the level of Lake Michigan, the shore of which is only four blocks distant from the school.

Cellotex-treated Ensemble Studio of WSOE, with double plate-glass windows which allow broadcast programs to be seen from the large "Ambler" plastered Radio Auditorium and Studio on the right. One of the three scientifically laid out WSOE Studios in the School of Engineering Building.

School of Engineering of Milwaukee Owns and Operates W S O E and 9 S O

WSOE Studios

The three studios are located on the third floor. The large Radio Auditorium, 33 ft. by 73 ft., is said to be one of the largest acoustically-plastered broadcasting studios. It furnishes ample room for the accommodation of large groups of broadcast artists, such as: bands, choruses, conservatories of music, etc. It is covered completely with Ambler acoustical plaster, and has an adequate cellotex-lined stage for lectures and regular broadcasting.

In addition to the Auditorium there are two smaller studios: The Solo and Ensemble studios.

Private wires for remote-control radiocasting and for intercommunicating are always being constructed and installed at various points throughout the vicinity, when and where there may be interesting or unusual features which cannot be brought to the school studios.

Amateur Radio Station 9SO

Besides the 1,000-watt Radiocast Station WSOE, the School of Engineering owns and operates a 50-watt, 40-meter amateurs' "Code" station, which is an outgrowth of the original 9YAD wireless-telegraph license of the school. 9SO is given over to instruction of, and practice for those students of the school who hold proper amateur licenses, and are members of the Students' Radio Club, where "Code" practice is a part of the members' activities. Each qualified student-operator "works" the station in rotation, and intercommunication has been established with other schools and colleges, and others, and is solicited with amateurs all over the world. It is designed to be useful as a radio telegraph laboratory and an adjunct to WSOE.

Its transmitter was designed and constructed by the students, under the supervision of the faculty members, and uses an inductively-coupled Hartley circuit. The receiver used is a 40-meter, regenerative circuit. A motor-generator set supplies both the 10-volt and 1,000-volt direct-current power. The antenna is supported by the towers of WSOE, and the entire equipment is housed adjacent to WSOE's Transmission Room on the roof of the School of Engineering Building, at 163 East Wells Street, Milwaukee.

The Power Room with its 1,600-cell, 3,200-volt Willard Storage "B" Battery, 15-cell, 540-ampere-hour Willard Storage "A" Battery and the various charging equipment and throw-over switches used to control these high-powered battery units.